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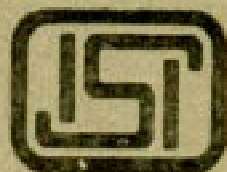
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*Indian Standard*

METHODS OF TEST FOR TYRE YARNS,  
CORDS, AND TYRE CORD FABRICS  
MADE FROM MAN-MADE FIBRES

PART IX SAMPLING FOR TYRE YARNS, CORDS AND  
TYRE CORD FABRICS MADE FROM RAYON

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INDIAN STANDARDS INSTITUTION  
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# Indian Standard

## METHODS OF TEST FOR TYRE YARNS, CORDS, AND TYRE CORD FABRICS MADE FROM MAN-MADE FIBRES

### PART IX SAMPLING FOR TYRE YARNS, CORDS AND TYRE CORD FABRICS MADE FROM RAYON

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**IS: 4910 ( Part IX ) - 1978**

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## *Indian Standard*

### **METHODS OF TEST FOR TYRE YARNS, CORDS, AND TYRE CORD FABRICS MADE FROM MAN-MADE FIBRES**

#### **PART IX SAMPLING FOR TYRE YARNS, CORDS AND TYRE CORD FABRICS MADE FROM RAYON**

### **0. FOREWORD**

**0.1** This Indian Standard ( Part IX ) was adopted by the Indian Standards Institution on 20 January 1978, after the draft finalized by the Sampling Methods Sectional Committee had been approved by the Textile Division Council.

**0.2** This standard has been prepared on the specific request of the Subcommittee for physical Methods of Test for Man-Made Fibre Textiles ( TDC 1 : 20 ) and forms a necessary adjunct to other parts of IS : 4910.

**0.2.1** The number of tests for determination of various characteristics are based on results of the analysis of extensive amount of data collected from various organizations to ascertain the inherent variability.

**0.2.2** The sampling procedure laid down in this standard is recommendatory and the buyer and the seller may agree either to modify it or adopt any other procedure.

**0.3** In reporting the result of a test or analysis, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS : 2-1960\*.

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### **1. SCOPE**

**1.1** This standard ( Part IX ) prescribes the methods for sampling of tyre yarns, tyre cords and tyre cord fabrics for determination of various physical characteristics, namely, linear density, breaking load, elongation, tenacity, thickness gauge, twist, dip pick up, heat shrinkage and heat shrinkage force, wet contraction and wet contractile force, heat degradation, adhesion and growth. It specifies the number of tests for determination of various characteristics with specified degree of accuracy. It also lays down the criteria for ascertaining the conformity to the specified requirements.

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\*Rules for rounding off numerical values ( revised ).

## **2. TERMINOLOGY**

**2.0** For the purpose of this standard, the following definitions in addition to those given in IS : 4910 ( Part VI )-1970\* shall apply.

**2.1 Consignment** — The quantity of tyre yarn, tyre cord or tyre cord fabrics delivered to a buyer against a despatch note.

**2.2 Lot** — All packages of tyre yarn or tyre cord or rolls of tyre cord fabrics of definite type and quality belonging to a consignment.

**2.3 Limit of Error of Mean** — The maximum difference between the sample mean and its true value ( that would be obtained if all the units in the lot were tested ) at a given probability level.

**2.4 Mean** — The sum of observations divided by the number of observations ( *see* Appendix A ).

**2.5 Range** — The difference between the largest and the smallest observations in the sample ( *see* Appendix A ).

**NOTE** — In case the number of results in the sample is 10 or more, they shall be divided into sub-groups of 5 test results each taking them consecutively in the same order as obtained. The range of each sub-group shall then be determined with a view to obtaining the mean range ( *see* 2.6 ).

**2.6 Mean Range** — The mean of a set of ranges calculated for sub-groups in the sample ( *see* 2.5 and Appendix A ).

**2.7 Sample** — Collection of packages of tyre yarn or tyre cords or tabbies from rolls of tyre cord fabrics selected for inspection from a lot.

**2.8 Test Specimen** — A specific portion of the yarn selected from a package of yarn or cord or tabby for performing single test.

## **3. SAMPLING OF TYRE YARN OR TYRE CORD**

**3.1** Unless otherwise agreed between the buyer and the seller, the number of packages of yarn or cord to be taken from a lot shall be in accordance with Table 1.

**3.2** The packages shall be selected at random from a lot, and in order to ensure randomness of selection of packages, IS : 4905-1968† shall be used.

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\*Methods of test for tyre yarns, cords, and tyre cord fabrics made from man-made fibres: Part VI Definition of terms.

†Methods for random sampling.



**TABLE 1 NUMBER OF PACKAGES TO BE CHOSEN FROM A LOT**

( Clause 3.1 )

NUMBER OF PACKAGES IN THE LOT	NUMBER OF PACKAGES TO BE SELECTED
Up to 50	2
51 „ 100	3
101 „ 300	5
301 „ 500	8
501 „ 1 000	13
1 001 „ 3 000	20

**3.3 Number of Tests**

**3.3.1** The minimum number of tests to be made for various characteristics shall depend upon the accuracy with which the characteristics are to be determined. Tables 2 to 5 give the number of tests necessary for the tyre yarn and tyre cord manufactured in the country for determination of linear density, breaking load, elongation, tenacity, thickness gauge and twist for varying limits of error. The probability level for number of tests given in Tables 2 to 5 varies between 95 to 98 percent.

**TABLE 2 NUMBER OF TESTS FOR LINEAR DENSITY**

Limit of error of mean in denier	3	4	5	8	11
Number of tests	65	40	25	10	5

**TABLE 3 NUMBER OF TESTS FOR BREAKING LOAD**

Limit of error of mean in kg	0.2	0.3	0.4	0.5
Number of tests	65	30	20	10

**TABLE 4 NUMBER OF TESTS FOR ELONGATION, TENACITY AND THICKNESS GAUGE**

( Clause 3.3.1 )

CHARACTERISTICS	LIMIT OF ERROR OF MEAN ( PERCENT )							
	1	1.5	2	3	4	5	7	8
Elongation	—	—	45	20	15	10	5	—
Tenacity	—	30	20	10	5	—	—	—
Thickness gauge	20	10	5	—	—	—	—	—

NOTE — Where the number of tests have become too large or too small, they have not been specified.

**TABLE 5 NUMBER OF TESTS FOR TWIST**

( Clause 3.3.1 )

Limit of error of mean	0.1	0.15	0.2
Number of tests	20	10	5

**3.3.2** Unless otherwise agreed between the buyer and the seller, 25 tests for linear density, and 20 tests for breaking load, tenacity, elongation and twist and 5 tests for thickness gauge shall be made for all routine testing.

**3.3.2.1** As far as possible equal number of test specimens shall be drawn from each package drawn according to 3.1 and 3.2. The number of test specimens taken from each package shall be determined by dividing the number of tests to be conducted ( see Tables 2 to 5 ) by the number of packages selected ( see Table 1 ). If it comes out to be a fractional number, its maximum integral part ( say 1 ) shall be taken and 1 or ( 1 + 1 ) specimen shall be taken from each selected package so as to obtain the requisite number of test specimen. In case the number of tests are less than the number of packages selected, one or more test specimens may be drawn from each selected package to get the number of test specimen to be an integral multiple of 5. For example, when there are 301 to 500 packages in the lot, 8 packages are selected for testing. According to 3.3.2, for routine testing, the number of tests for breaking load are 20 while they are 5 for thickness gauge. For drawing test specimens for breaking load tests, 20 test specimens are to be taken from 8 packages. Thus 2 ( maximum integral part of 20/8 ) test specimens are taken out from each of 8 packages giving only 16 test specimens. The remaining 4 ( i.e., 20-16 ) test specimens are drawn one each from any 4 of the 8 packages.

In case of thickness gauge, the number of packages drawn (8) is greater than the number of test specimens (5) required. Hence instead of testing only 5 test specimens, 10 (the smallest integral multiple of 5 greater than 8) test specimens are tested. Here one test specimen is drawn from each of the 8 packages and the remaining 2 (i.e., 10-8) test specimens are drawn one each from any two of the 8 packages.

**3.3.3** The number of tests for determination of other characteristics, namely, dip pick up, heat shrinkage and heat shrinkage force, wet contraction and wet contractile force, heat degradation, adhesion and growth shall be 2.

#### 4. SAMPLING OF TYRE CORD FABRICS

**4.1** One tabby shall be taken for each creel load in a lot.

**4.2** The number of cords taken out from each tabby shall depend on the number of tabbies available for testing and the desired limit of error of mean for the determination of the characteristic.

**4.2.1** Table 6 gives the number of cords to be taken out from each tabby for the characteristic breaking load for varying limits of error. In case there are 3 or 4 tabbies representing the lot and the limit of error of mean of 0.5 is chosen, then more cords shall be drawn from 1 or 2 tabbies so that the total number of cords tested are equal to 10.

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**TABLE 6 NUMBER OF CORDS PER TABBIES  
FOR BREAKING LOAD**

NO. OF TABBIES	LIMIT OF ERROR OF MEAN		
	0.3	0.4	0.5
2	—	—	5
3	—	10	3
4	10	5	2
5	7	3	—
6	5	—	—

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**4.2.2** For other characteristics, namely, linear density, tenacity, elongation, twist and thickness, the number of tests shall be as given in 3.3.2.

**4.2.3** For the remaining characteristics, namely, dip pick up, heat shrinkage and heat shrinkage force, wet contraction and wet contractile force, heat degradation, adhesion and growth, the number of tests shall be as given in 3.3.3.

## 5. CRITERIA FOR CONFORMITY

5.1 For ascertaining the conformity of the lot to the specification requirements, the following procedure shall be adopted.

5.1.1 *One-Sided Specification Limit* — The lot shall be declared as conforming to the specification if:

- a) the value of the expression  $(\bar{x} - kR)$  or  $(\bar{x} - k\bar{R})$  is greater than or equal to  $L$ , when the lower specification limit  $L$  is given;

OR

- b) the value of the expression  $(\bar{x} + kR)$  or  $(\bar{x} + k\bar{R})$  is less than or equal to  $U$ , when the upper specification limit  $U$  is given.

where the values of the factor  $k$  are given in Table 7 for different sample sizes, and  $U$  and  $L$  refer to the specification limits for individual test results.

TABLE 7 VALUES OF THE FACTORS

( Clauses 5.1.1 and 5.1.2 )

SAMPLE SIZE ( $n$ )	$k$	$B$
5	0.3	1.0
10	0.4	0.9
15 and above	0.5	0.8

5.1.2 *For Two-Sided Specification Limits* — The lot shall be declared as conforming to the specification if:

- a) the value of the expression  $R / (U - L)$  or  $\bar{R} / (U - L) \leq B$ ,  
 b) the value of the expression  $(\bar{x} + kR)$  or  $(\bar{x} + k\bar{R}) \leq U$ , and  
 c) the value of the expression  $(\bar{x} - kR)$  or  $(\bar{x} - k\bar{R}) \geq L$ .

where the values of the factors  $B$  and  $k$  are given in Table 7 for different sample sizes, and  $U$  and  $L$  refer to the specification limits for individual test results.

## APPENDIX A

( *Clauses 2.4, 2.5 and 2.6* )

## GLOSSARY OF SYMBOLS

- $\bar{x}$  Mean; if  $x_1, x_2, \dots, x_n$  are the  $n$  measurements of the items in a sample, then

$$\bar{x} = \frac{x_1 + x_2 + \dots + x_n}{n}$$

- $R$  Range; if  $x_1, x_2, \dots, x_n$  are the measurements of items in a sample arranged in the ascending order of magnitude, then  $R = x_n - x_1$ .

- $\bar{R}$  Mean range; if  $R_1, R_2, \dots, R_m$  are the range of  $m$  sub-groups of five observations each ( so that the sample size  $n = 5 m$  ), then

$$\bar{R} = \frac{R_1 + R_2 + \dots + R_m}{m}$$

- $k$  Coefficient of  $R$  or  $\bar{R}$  for the criteria for conformity.

- $B$  Maximum value for the expression  $\frac{R}{U-L}$  or  $\frac{\bar{R}}{U-L}$  in criteria for conformity for two-sided specification limits.

$U$  Upper specification limit.

$L$  Lower specification limit.

$\leq$  Less than or equal to.

$\geq$  Greater than or equal to.

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## **QUALITY CONTROL, STATISTICAL METHODS AND SAMPLING**

**IS:**

- 397 ( Part I )-1972 Methods for statistical quality control during production: Part I Control charts for variables
- 397 ( Part II )-1975 Methods for statistical quality control during production: Part II Control charts for attributes and count of defects
- 1548-1969 Manual on basic principles of lot sampling (*revised*)
- 2500 ( Part I )-1973 Sampling inspection tables: Part I Inspection by attributes and by count of defects (*first revision*)
- 2500 ( Part II )-1965 Sampling inspection tables: Part II Inspection by variables for percent defective
- 3919-1966 Methods for sampling cotton fabrics for the determination of physical characteristics
- 3920-1966 Methods for sampling of cotton yarns for the determination of physical characteristics
- 4905-1968 Methods for random sampling
- 4952-1968 Methods for sampling of cotton-bales, slivers and rovings
- 5002-1969 Methods for determination of sample size to estimate the average quality of a lot or process
- 5420 ( Part I )-1969 Guide on precision of test methods: Part I Principles and applications
- 5420 ( Part II )-1973 Guide on precision of test methods: Part II Inter-Laboratory testing
- 5463-1969 Methods for sampling of cotton fabrics for chemical tests
- 6200-1971 Statistical tests of significance
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- 7600-1975 Analysis of variance
- 7920 ( Part I )-1976 Statistical vocabulary and symbols: Part I General statistical terms
- 7920 ( Part II )-1976 Statistical vocabulary and symbols: Part II Terms used in sampling and process control

# INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

## Base Units

Quantity	Unit	Symbol
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

## Supplementary Units

Quantity	Unit	Symbol
Plane angle	radian	rad
Solid angle	steradian	sr

## Derived Units

Quantity	Unit	Symbol	Conversion
Force	newton	N	1 N = 0.101 972 kgf
Energy	joule	J	1 J = 1 N.m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m <sup>2</sup>
Frequency	hertz	Hz	1 Hz = 1 c/s (s <sup>-1</sup> )
Electric conductance	siemens	S	1 S = 1 A/V
Pressure, stress	pascal	Pa	1 Pa = 1 N/m <sup>2</sup>

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